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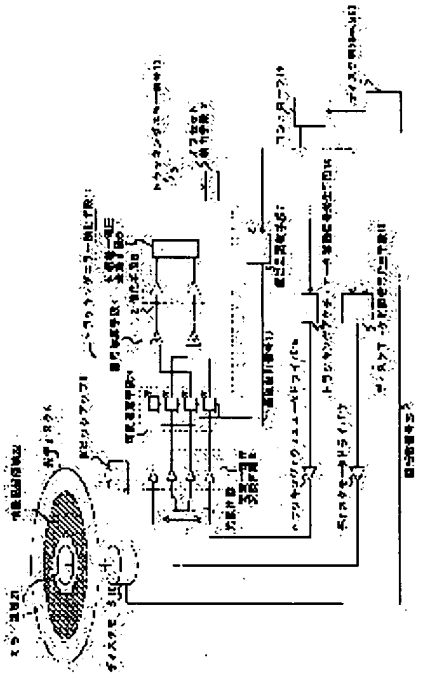
(54) OPTICAL DISK DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce an offset superposed upon the tracking error signal of an optical disk device, by making plural signal reproducing speeds changeable during operation.

SOLUTION: The output signal of a signal adding means 4 is compared with a reference level to output a binary signal by a binarizing means 5. The phase difference between these binary signals is detected to output a voltage by a phase difference-voltage converting means 6. A tracking error signal corresponding to deviation amt. between the center of a light spot and the center of a virtual track is detected and outputted by a tracking error detecting means 11. At the time of changing operation of plural information reproducing speeds, the controlling signal phase difference dipends on pit depth and laser wave and is not changed even by changing the reproducing speeds. However, since a setting delay time is different to obtain the same phase difference at a changed reproducing speed, a delay time setting is changed



to correspond to a speed change-over.

* NOTICES *

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2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1]In an optical disk unit which uses a phase contrast tracking error detection system for a tracking error detection system, a direction by which an information storage track direction is mapped on a photodetector -- abbreviated -- the 1st parallel parting line and said 1st parting line -- abbreviated -- with a photodetector quadrisected by the 2nd vertical parting line. When the 2nd parting line divides to 4 sets of signals from this photodetector, A variable delay means constituted so that the same delaying amount as a signal from a light-receiving portion in a position arranged to the same field might be given, 2 sets of adding means constituted so that a signal from a light-receiving portion which is in a diagonal position on this photodetector among 4 sets of signals outputted from this variable delay means might be added, respectively, A tracking error signal detection means to acquire a tracking error signal from phase contrast between signals outputted from this adding means, So that an offset ingredient outputted from an offset detection means and this offset detection means of detecting an offset ingredient of a tracking error signal outputted from this tracking error signal detection means may serve as the minimum mostly. A delaying amount control means which outputs a delay time control signal of said variable delay means, and a tracking actuator control means only for a predetermined distance to displace a tracking actuator, In order to rotate a disk motor at predetermined number of rotations A disk motor control means, A slider control means to which a position is made to move a slider in which an optical pickup was carried, A focus servo control means for applying a focus to a signal recording layer of the purpose of this optical disc, Provide a disk discrimination method which distinguishes classification of an optical disc with which it was equipped, and a controller which controls this optical disk unit, and this controller, When it judges that this offset ingredient needs to be decreased, It is made to control so that disk motor number of rotations turns into target revolving speed to this disk motor control means, Light spot irradiated by this tracking actuator control means on this

optical disc makes it control so that only a predetermined distance of this optical disc radially is displaced, This offset detection means is made to detect an offset ingredient of a tracking error signal in the above-mentioned state, An optical disk unit performing offset control processing performed by changing a delay control signal given to this variable delay means to this delaying amount detection means based on information about a detected offset amount repeatedly until this offset amount becomes below in a predetermined value.

[Claim 2]In the optical disk unit according to claim 1, a controller, It is made to distinguish whether when this optical disk unit is equipped with a disk, it is a disk corresponding to [disk / this] a disk discrimination method in this optical disk unit, An optical disk unit making a delaying amount control means perform delaying amount adjustment when this disk distinguishes that it is the disk with which this optical disk unit corresponded.

[Claim 3]In the optical disk unit according to claim 1, a controller, It is made to distinguish whether when this optical disk unit is equipped with a disk, it is a disk corresponding to [disk / this] a disk discrimination method in this optical disk unit, When this disk distinguishes that it is the layered disk in which this optical disk unit corresponds, while making this delaying amount control means perform delaying amount adjustment to all the layers of this optical disc, An optical disk unit outputting a memorized delaying amount adjustment result corresponding to a signal recording layer to play as a delay amount control signal from this delaying amount control means in making this delaying amount adjustment result memorize and playing a signal from this optical disc.

[Claim 4]In the optical disk unit according to claim 1, a controller, Operation for which a slider in which an optical pickup was carried at a slider control means is moved to a position before making a delaying amount control means perform delaying amount adjustment to this optical disc, An optical disk unit performing operation which makes a signal recording layer of the purpose of this optical disc apply a focus to a focus servo control means.

[Claim 5]An optical disk unit, wherein fields where light spot under delaying amount control plays a signal from this optical disc in the optical disk unit according to claim 4 are fields other than a mirror surface of this optical disc.

[Claim 6]An optical disk unit, wherein a position of an inner periphery end of light spot under delaying amount control of a position to which a slider control means moves a slider in which an optical pickup was carried in the optical disk unit according to claim 5 is a not less than 24-mm position in this optical disc radius.

[Claim 7]An optical disk unit before a controller's making a delaying amount control means perform delaying amount adjustment to this optical disc, wherein it makes a disk motor control means start disk motor revolving speed control in the optical disk unit according to claim 1.

[Claim 8]In the optical disk unit according to claim 1, a disk motor control means Back electromotive force of the disk motor itself, An optical disk unit maintaining number of rotations

of this optical disc at a predetermined value using disk motor rotational frequency information detected or more from any one of the rotational frequency detection means mechanically connected to a signal and a disk motor which are obtained from a disk motor drive circuit.
[Claim 9]In the optical disk unit according to claim 1, target revolving speed of this optical disc controlled by a disk motor control means at the time of offset control, An optical disk unit, wherein this slider control means is the number of rotations corresponding to the usual signal regeneration speed in a position to which a slider in which an optical pickup was carried was moved.
[Claim 10]In the optical disk unit according to claim 9, when this optical disk unit supports two or more signal regeneration speed, Target revolving speed of this optical disc controlled by a disk motor control means at the time of offset control, An optical disk unit, wherein this slider control means is the number of rotations corresponding to signal regeneration speed between the minimum signal regeneration speed in a position to which a slider in which an optical pickup was carried was moved, and the highest signal regeneration speed.
[Claim 11]In the optical disk unit according to claim 10, with signal regeneration speed nearest to signal regeneration speed of an average of the minimum signal regeneration speed and the highest signal regeneration speed corresponding to target revolving speed of this optical disc controlled by a disk motor control means at the time of offset control. An optical disk unit being the number of rotations corresponding to signal regeneration speed which can be set as this optical disk unit.
[Claim 12]In the optical disk unit according to claim 1, a tracking actuator control means quantity which displaces a tracking actuator at the time of offset control, An optical disk unit characterized by being a distance almost equal to an optical disc radial direction, and the direction of the displacement being reverse direction a center [a mechanical center valve position of a tracking actuator].

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]In the optical disk unit with which this invention uses a phase contrast tracking error detection system for a tracking error detection system, It is related with an optical disk unit with the function to amend the phenomenon which a direct-current-offset ingredient superimposes on a tracking error signal when especially an object lens moves to the radial direction of an optical disc, and to adjust mostly to the minimum the direct-current-offset ingredient on which it is superimposed.
[0002]
[Description of the Prior Art]When an object lens moves to the radial direction of an optical disc in the optical disk unit which uses a phase contrast tracking error detection system (for example, JP,57-181433,A) for a tracking error detection system, the phenomenon which an offset ingredient superimposes on a tracking error signal is known. It is required for a tracking error signal for an offset ingredient to control this, since superposition and tracking control become unstable. Then, JP,62-165737,A is devised in order to reduce the offset ingredient superimposed on a tracking error signal.
[0003]
[Problem(s) to be Solved by the Invention]The method of reducing the offset ingredient superimposed on the tracking error signal of JP,62-165737,A illustrated for the preceding clause, Reference is not made about the inhibition method of the offset about an optical disk unit with required signal regeneration speed using those with two or more, and each signal regeneration speed, changing them working. There is a technical problem of this invention in realizing the reducing method of the offset which superimposes two or more signal regeneration speed on the tracking error signal in the optical disk unit which can be changed working. The optical disc which an optical disk unit makes a reproduction object is not

mentioned about the inhibition method of the offset about the optical disk unit with which those with two or more kinds may differ from the pit depth on which information is recorded among them.

[0004]There is the 2nd technical problem of this invention in realizing the reducing method of the offset superimposed on the tracking error signal in the optical disk unit corresponding to two or more kinds of optical discs with different pit depth. Reference is not made about the inhibition method of the offset about an optical disk unit with required the information storage side which should be played from one side using it for the optical disc which an optical disk unit makes a reproduction object between ****s and those layers more than two-layer, changing to it working.

[0005]There is the 3rd technical problem of this invention in realizing the reducing method of the offset which superimposes two or more information storage sides on the tracking error signal in the optical disk unit which can be changed working.

[0006]

[Means for Solving the Problem]Signal regeneration speed belonging to the 1st classification that actually performs time delay adjustment for two or more signal regeneration speed which can be set up, and calculates a preset value about the 1st technical problem, It classifies into two kinds of signal regeneration speed belonging to the 2nd classification using a preset value calculated by an operation based on information acquired by adjustment without performing lens shift offset control, A specific relation is given to a ratio of signal regeneration speed of these two kinds, and a preset value at reproduction speed belonging to the 2nd classification is solved by obtaining from a preset value at reproduction speed to which the 1st classification belongs by computing according to a ratio of the above and reproduction speed.

[0007]A means to change a time delay of a signal delay means for offset control about the 2nd technical problem, A means to measure an offset amount, and a control means that a time delay is adjusted from a measured offset amount, and an offset amount serves as the minimum mostly are established, and it solves by adjusting so that an offset amount may serve as the minimum mostly using the above-mentioned means for each optical disc of every.

[0008]When it becomes clear that there is an information storage side which should be played from one side by disk discrimination more than two-layer about the 3rd technical problem, a time delay of offset is adjusted in each information storage side, The result is memorized, and at the time of signal regeneration, when making it an offset amount serve as the minimum mostly using an adjustment value of a memorized time delay for each information storage side of every, it solves.

[0009]

[Embodiment of the Invention]The example of an embodiment of the invention is hereafter explained using figures. A focus servo for an optical disk unit to maintain the focus of light spot

in the position of the purpose of the signal recording surface of a disk generally here, In order to restore to servo blocks, such as a tracking servo and a seeking servo, and regenerative data Signal regeneration, It comprises a decoder block which performs a recovery, an error correction, etc., and a system control block which performs control of the whole optical disk unit, The encoder block of the interface block which performs an interface with an external information management system further for the purpose of apparatus, the abnormal conditions for recording data, an error correction, etc., etc. is added. However, about this invention and a directly unrelated block, explanation and the statement to a drawing are omitted among these blocks.

[0010]Drawing 1 is a block diagram of the optical disk unit which accomplishes the constituent features of this invention in the 1st example of an embodiment of this invention. An outline is first explained about the function of each block in the figure. The optical disc 8 is an information storage medium which can be read optically [a compact disk (CD), a digital versatile disk (DVD), etc.], and information is recorded on the signal recording surface in the crevice called a pit. Although one fourth of the laser beam wavelength lambda with which it irradiates for reading is desirable as for the depth of the crevice of a pit, it has **lambda / about [10] dispersion focusing on lambda/4 actually. For example, the optical disk unit corresponding to [since the wavelength of the laser beam for reading specified in the standard which should be based in CD and DVD, respectively differs] both optical discs, Even if pit depth is created for each disk by lambda/4 as the standard, when reading with a single laser wavelength, in one of disks, pit depth cannot but become the thing [// 4 / lambda] shifted.

[0011]The optical pickup 9 is for playing information from the optical disc 8, and comprises a semiconductor laser, an optic, a focus actuator, a tracking actuator, and a photodetector. The light emitted from the semiconductor laser connects a focus with the signal recording surface of the optical disc 8, and forms light spot. Since the light volume reflected from light spot changes with the existence of a pit, it can perform signal regeneration by detecting change of light volume as a signal.

[0012]It is for the photodetector 1 changing change of the reflected light quantity from the optical disc 8 into a current signal. The light-receiving portion is quadrisected by the parting line of the direction of A-A', and the parting line of the direction almost vertical to this, and has composition in which signal detection is independently possible from each light-receiving portion. the photodetector 1 -- the information storage track direction of the optical disc 8 -- about [of the photodetector 1] -- it arranges by optical pickup 9 inside so that it may be mapped in the direction of A-A'. The current-voltage converting means 2 comprises 4 sets of current-voltage conversion circuits, and transforms into a voltage signal the current signal acquired from each light-receiving portion by which the photodetector 1 was quadrisected, respectively.

[0013]The tracking error detection means 11 comprises the variable delay means 3, the signal adding means 4, the binary-ized means 5, and the phase contrast-voltage converting means 6. The variable delay means 3 comprises 4 sets of variable delay circuits, and supports 4 sets of signals from the current-voltage converting means 2, respectively. each variable delay circuit follows the delay control signal 10 outputted from the delaying amount adjustment device 7 in an input signal -- predetermined time -- you make it delayed and it outputs. When it classifies by a parting line almost vertical to the direction of A-A' on the photodetector 1 among 4 sets of signals outputted from the current-voltage converting means 2, the delay control input of each variable delay circuit is constituted so that the same delaying amount as the signal from the light-receiving portion in the position arranged to the same field may be given.
[0014]The signal adding means 4 is constituted so that the signal from the light-receiving portion which is in a diagonal position on the photodetector 1 among 4 sets of signals outputted from the variable delay means 3 may be added, respectively. The binary-ized means 5 comprises a voltage comparator and outputs the result of having responded the signal inputted from the signal adding means 4 to both size relation as compared with predetermined reference level, as a binary signal.
[0015]The phase contrast-voltage converting means 6 is constituted so that the phase contrast between the inputted binary signals may be detected and the voltage according to the detected phase contrast may be outputted. By the above composition, the tracking error detection means 11 detects the tracking error signal corresponding to the amount of gaps of a light spot center and the virtual track center on a disk, and outputs a tracking error signal. Although the tracking error signal acquired here is inputted also into a tracking-servo-control system (not shown) and tracking control is performed by this signal, Since this is publicly known as tracking servo control at the time of performing the usual data reproduction, detailed explanation is omitted here.
[0016]The offset detection means 12 is constituted by the signal processing means which is for detecting the offset value of the tracking error signal outputted from the tracking error detection means 11, and has a function equivalent to a low pass filter or it. The delaying amount adjustment device 7 performs predetermined processing from the information on the offset ingredient of the tracking error signal detected by the offset detection 12 with the control signal of the controller 19, and in order to amend offset, it outputs the delay control signal 10 added to the delay control input of the variable delay means 3.
[0017]With the control signal of the controller 19, the tracking actuator shift signal generating means 14 gives a driving signal only for a predetermined distance to displace a tracking actuator (not shown) to predetermined timing to the tracking actuator driver 15.
[0018]With the control signal of the controller 19, the disk motor control signal generation means 16 gives a driving signal to the disk motor driver 17 in order to rotate the disk motor 18

at predetermined number of rotations by predetermined timing. The number of rotations of the disk motor 18 is detected by a rotational frequency detection means (not shown), and the rotation speed signal 20 is inputted into the disk motor control signal generation means 16. The disk motor control signal generation means 16 controls a driving signal to become predetermined number of rotations based on the rotation speed signal 20. The disk discrimination method 23 detects the existence of wearing of an optical disc, the classification of the optical disc with which it was equipped, etc. from an RF signal, a focus error signal, a tracking error signal, etc., and outputs a detection result to the controller 23.

[0019]Next, the example of an embodiment of the procedure performed for control of the phase contrast tracking offset in an optical disk unit to accumulate is explained. CPU (not shown) which functions as the system controller 19 in the example of a gestalt of the following processings uses for an example with software the case where the processing is performed. Hereafter, the outline of procedure is explained. A phase contrast tracking detection method is a method of detecting a tracking error signal from the edge detection timing information of the pit signal currently recorded on the optical disc. Then, also when performing offset control, phase contrast tracking detection is actually performed, a tracking error signal is acquired, and the technique of changing the time delay in a variable delay means, and finding out the best time delay so that the offset ingredient on which this is overlapped may serve as the minimum is taken.

[0020]The introduction phase contrast tracking offset adjustment is pretreated. The disk tray for disk wearing of an optical disk unit closes, and if it becomes the situation of it being equipped with a disk and getting, the existence of disk wearing will be detected first. When it judges that it is equipped with the disk, the optical disk unit concerned judges whether it is the target thing, if it is an optical disc of the target kind, processing will be continued, and if the disk kind with which it is equipped is outside an object, it will discharge the optical disc. When the optical disk unit concerned judges that it was equipped with the target optical disc by the above-mentioned pretreatment, it progresses to the next phase contrast tracking offset regulated treatment.

[0021]Drawing 2 shows the processing flow chart of phase contrast tracking offset adjustment of this invention. In this example of an embodiment, the most-inner-circumference position sensing device which detects the state where a slider is near the most-inner-circumference portion at a slider mechanism system, and the slider mechanism system which has distance sensors which detect the relative migration distance of the slider from arbitrary reference positions are used for an example. The 1st processing in the processing flow chart of drawing 2 is slider position control. -- It is (2). This moves the slider in which the pickup is carried to the prescribed position, and enables it to play the signal from the prescribed position of an optical disc. It is necessary to move an optical pickup to data recording regions so that the edge

detection timing information of a pit signal may certainly be acquired, when performing phase contrast tracking error offset control.

[0022]Hereafter, the reason is explained. In optical discs, such as CD and DVD, information is not recorded on read in area of data recording regions which is in the inner circumference side further, and read out area of data recording regions which is in the periphery side further, and since a pit signal is not acquired here, offset control cannot be performed. Although the position of read in area has become settled by the standard, since the amount of information recorded on an optical disc is not constant, the position of read out area of data recording regions located immediately outside changes with disks. In adjustment, a tracking actuator is actually displaced and the tracking error offset signal at that time is measured. Therefore, even when displacing a tracking actuator to the inner circumference [of an optical disc], or periphery side, it is necessary to make it the light spot which is carrying out signal regeneration not separate from data recording regions. It is necessary to specify the position of the slider in which the optical pickup is carried from the above-mentioned reason.

[0023]So, in this example of an embodiment, in order to perform tab control specification of a slider, the following methods are taken. A slider is moved to a most-inner-circumference portion until the most-inner-circumference detection sensor operates first, and let this be the initial position Xi. Next, a slider moves, measuring migration length with distance sensors until predetermined does distance Y movement of. A slider position serves as Xi+Y in this state. If tracking actuator displacement at the time of adjustment is set to **Z here, a light spot position will serve as the range of Xi+Y**Z. Therefore, the slider position at the time of tracking error offset control is the range of Xi+Y**Z. Here, if the starting position of Li and the periphery side mirror part is set to Lo for the end position of the inner circumference side mirror part which becomes settled from a standard, Li<Xi+Y-Z and Xi+Y+Z<Lo will serve as conditions which have light spot on data recording regions.

[0024]Then, Xi and Y are set up fulfill the above-mentioned conditions by this example of an embodiment. Thereby, when performing phase contrast tracking error offset control, pit information can certainly be acquired.

[0025]The 2nd processing in the processing flow chart of drawing 2 is focus servo control. -- It is (3). In order that this may acquire the pit signal currently recorded on the optical disc, it starts focus servo control and enables it to acquire the regenerative signal from an optical disc. It is necessary to perform focus servo control for acquiring the edge detection timing information of a pit signal in the case of offset control as above-mentioned. Since this is completely the same as that of the time of performing focus servo control when it performs the usual data reproduction, detailed explanation is omitted here.

[0026]The 3rd processing in the processing flow chart of drawing 2 is disk motor servo control. -- It is (4). This starts disk motor servo control so that disk motor number of rotations may turn

into the almost same number of rotations as signal regeneration speed, and it is made to serve as the range almost of predetermined in the regenerative-signal frequency from an optical disc. Here, about the control method of disk motor number of rotations, and the value of target revolving speed, since two or more technical technical problems are related, the detailed explanation is given to below.

[0027]In order to acquire the edge detection timing information of a pit signal, it is required to rotate an optical disc at predetermined number of rotations. Usually, at the time of signal regeneration, the optical disk unit which plays optical discs, such as CD and DVD, detects clock timing from the information currently recorded on the optical disc, and takes the composition which controls the number of rotations of a disk motor so that this serves as predetermined frequency. This keeps constant the linear velocity in an information reproduction track. However, when performing phase contrast tracking offset adjustment, since it will become the offset ingredient superimposed on a tracking error signal is oppressed by the open loop gain of a servo system, and difficult [the detection] if tracking servo control is performed, tracking servo control cannot be performed.

[0028]When not performing tracking servo control, it is difficult to intermingle the information from two or more tracks, and for the signal played from a disk to detect clock timing from the information currently recorded, and to control the number of rotations of a disk motor. Therefore, it is necessary to control disk motor number of rotations by disk motor rotational frequency information acquired from other than the optical disc at the time of phase contrast tracking offset adjustment.

[0029]There are the following methods as a means to acquire rotational frequency information from other than an optical disc. First, methods of detecting rotational frequency information from a disk motor directly include the method of measuring the back electromotive force of a disk motor. A motor can use the method of this regardless of a brush motor and a brushless motor. Since a motor drive circuit for exclusive use is needed in the case of a brushless motor, a Hall element output signal can be branched from this circuit, and rotational frequency information can be detected from the frequency of this signal. A rotary encoder and a frequency generator (FG) are added to a disk motor, and there is also a method of acquiring a signal from these.

[0030]Disk motor number of rotations is controllable to the target angular velocity by performing feedback control using the method mentioned above. Although there are various things, such as a method held by hardware about the actual motor-rotation-frequency control method and a method held by software, it may carry out by which method, and since those control systems are not the essence of this invention, explanation is omitted.

[0031]Here, it was already said that it is that the purpose of disk motor speed control keeps constant the linear velocity which plays information from a disk. Therefore, in the slider position

which fulfills the above-mentioned conditions, the disk motor number of rotations which should be made control objectives is number of rotations which serves as linear velocity at the time of the usual signal regeneration, and the same linear velocity. If this sets the position of a disk radial [in / for the linear velocity at the time of signal regeneration / VL and a light spot position (approximately slider position)] to R, the relation of VL=2piRN will be materialized between the disk motor number of rotations N. Therefore, the target revolving speed N of the disk motor in this example of an embodiment is N=VL/(2piR). -- (1)
It comes out.

[0032]Here, the setting method of the linear velocity at the time of the signal regeneration at the time of performing phase contrast tracking error offset control is considered. Usually, optical disk reproducing devices, such as CD and DVD, control a disk motor so that the linear velocity to which light spot moves a disk top becomes fixed, when playing a signal from an optical disc. Therefore, as for the signal regeneration speed at the time of signal regeneration speed performing phase contrast tracking error offset control only in the case of one kind, it is common to suppose that it is the same as the speed which performs the usual information reproduction.

[0033]In this case, what is necessary is just to perform offset control once, when an optical disk unit is equipped with the optical disc concerned, and as long as there is no change of an environmental condition etc. to which an offset amount is changed, it does not need to readjust. At this time, the apparent signal delay of the variable delay means 3 and the signal phase contrast which should be adjusted are always in proportionality.

[0034]Next, the case where information reproduction speed uses those with two or more and them changing them working is assumed. Even in this case, it is only dependent on pit depth and a laser wavelength, and the signal phase contrast which should be controlled does not change at all, even if information reproduction speed changes. However, the time delays set up in order to acquire the same phase contrast, since signal regeneration speed is changing will differ, for this reason it will be necessary to change and reset time delay setting out corresponding to the change of information reproduction speed.

[0035]And the amount of time delays which should be reset cannot perform information reproduction operation after the change of information reproduction speed, shortly after not being known beforehand. Therefore, in order to avoid that such a situation occurs, it is necessary to grasp the time delay preset value which should be set up at all the information reproduction speed which is possible when an optical disk unit is equipped with an optical disc.

[0036]Performing offset control at all the information reproduction speed, in order to grasp here the time delay preset value which should be set up, For example, in the CD-ROM playback equipment corresponding to playback up to 8X, the offset control in speed, standard speed

(one X), 2X, 4X, 6X, and 8X, of five kinds is meant, and since the number of times of offset control increases 5 times, the problem of the increase in the initialization time at the time of disk wearing is caused.

[0037]In order to avoid such a problem, in this invention, the preset value of a time delay is acquired by the following method. It uses that the signal phase contrast which should be set up in order that this method may make offset the minimum, even when information reproduction speed changes as above-mentioned does not change. First, offset control is performed at a certain specific information reproduction speed S1, the optimal signal phase contrast P1 is found out, and the case where the time delay preset value T1 corresponding to this is acquired is assumed. Next, the case where information reproduction speed is changed to S2=S1xN is considered with the same optical disc. At this time, the optimal signal phase contrast P1 does not change.

[0038]Now, generally time delay deltat corresponding to this is deltat=P1/F at the time of the signal frequency F and the signal phase contrast P1. Time delay deltat' corresponding to [since it is equivalent to the signal frequency F having increased N times here that information reproduction speed increased N times and, as for signal frequency, FxN and signal phase contrast do not change / P1 and this time] this is deltat'=P1/(FxN)= (they are P1 / F/N=delta t/N.). Therefore, when information reproduction speed increases N times, it turns out that a time delay required to acquire the same signal phase contrast P1 is set to 1/N.

[0039]So, in this example of an embodiment, that where a time delay preset value and the time delay then acquired have a relation of almost known linearity is used for a variable delay circuit. Setting out can be easily done for the target time delay, without readjusting by computing a time delay preset value based on the above-mentioned relation, and setting this up, when information reproduction speed increases N times and sets a time delay to 1/N by this.

[0040]CD-ROM playback equipment is well known as an optical disk unit with two or more signal regeneration speed described so far. So, in this example of an embodiment, the combination machine of CD-ROM of 8X correspondence and DVD-ROM is assumed. In this case, even times as many those twice, 4 times, 6 times, and 8 times as many setting out [as] of the signal regeneration speed of CD-ROM is common on the basis of standard speed (namely, one X).

[0041]Now, if time delay adjustment is performed at one signal regeneration speed, the preset value at the time of changing to other signal regeneration speed can be acquired from the preset value acquired by adjusting then by computation, as the above-mentioned explanation described. Therefore, although it may adjust theoretically at which signal regeneration speed which can be set up, the speed which can be adjusted from the problem of an alignment error and an operation error is limited actually.

[0042]So, in the optical disk unit assumed in this example of an embodiment, the minimum of signal regeneration speed is set to SL, set a maximum to SH, and average SM = (SL+SH) / 2 of both, and let 4X which is the signal regeneration speed nearest to SM=4.5 when referred to as SL=1 and SH=8 be the speed which performs offset control. Thereby, influence of the alignment error and operation error which are generated except four X is made into the minimum. Since this is not restricted to the above-mentioned numerical example and set to SM=6.5, for example at the time of SL=1 and SH=12, it serves as speed at which 6X which is the speed nearest to this which can be set up performs offset control.
[0043]By things, making it be ****, without performing readjustment from the offset control result in signal regeneration speed of one kind, The time delay preset value in the signal regeneration speed in which other setting out is possible is acquired with the minimum error, and it becomes possible to perform offset control, without causing the increase in the initialization time at the time of disk wearing by setting up the offset adjusting value in the target signal regeneration speed almost simultaneously with the change of signal regeneration speed.
[0044]As a result of solving the technical technical problem about the control method of disk motor number of rotations explained above, and the value of target revolving speed, in the optical disk unit described in this example of an embodiment. The pit edge timing information from the signal regeneration field on an optical disc is detected at the disk motor number of rotations of 4X, without being based on the record signal on an optical disc, The tracking error signal by which offset control was carried out at the signal regeneration speed which can set up all future comes to be acquired almost simultaneously with the change of signal regeneration speed.
[0045]Below, a tracking offset ingredient is detected from a tracking error signal, and the method for acquiring the time delay preset value over a variable delay means which makes this the minimum mostly is explained. The 4th processing in the processing flow chart of drawing 2 is offset control. -- It is (5). The processing which detects an offset ingredient from a tracking error signal when this displaces a tracking actuator to a tracking direction, It is the combination of the processing which controls a time delay preset value so that it carries out changing a time delay preset value [as opposed to a variable delay means for this processing] and an offset ingredient becomes the minimum mostly.
[0046]Drawing 3 shows the flow chart about the offset control processing in the example of an embodiment of this invention. Drawing 4 is the key map which made the time delay preset value the parameter for the relation of the amount of tracking actuator displacement and offset value in subsequent processings. Hereafter, it explains according to drawing 3.
[0047]Let introduction and a time delay preset value be the initial values S1. next -- Displace a tracking actuator L1. -- detect (2) and offset ingredient VL1 of the tracking error signal at that

time. -- (3) -- it memorizes. next -- Displace a tracking actuator L2. -- detect (4) and offset ingredient VL2 of the tracking error signal at that time. -- (5) -- it memorizes.

[0048]Here, there is the feature that make it L1 and L2 become an opposite direction centering on the center valve position of a tracking actuator, subsequent processings will become easy if it is still the same [the absolute value], and the method of displacement of an actuator becomes easy. Therefore, it is referred to as L1=-L2 especially in this example of an embodiment.

[0049]In order to displace a tracking actuator in above-mentioned processing, As the functional description of drawing 1 described, input a predetermined signal into the tracking actuator control system 15, and a tracking actuator shift signal is generated from a tracking actuator shift signal generating means, It carries out by sending current through a tracking actuator through a tracking actuator drive circuit. This method is a known thing in an optical disk unit, for example, it can realize easily by diverting the circuit means for generating the acceleration pulse at the time of performing a track jump, and a decelerating pulse.

[0050]In order to detect and measure the offset amount of a tracking error signal in this example of an embodiment, Input into the delaying amount adjustment device 7 the offset ingredient detected by the offset detection means 12, and For the facilities of subsequent processings with the delaying amount adjustment device 7, After inputting an offset amount into an analog-digital converter (not shown) and changing it into digital signal information, this information is stored in an internal memory and performed.

[0051]Below, subsequent processings are explained. First, difference deltaVL of VL1 and VL2 is calculated, and the absolute value of deltaVL is compared with value deltaVL0 predetermined. -- Processing will be ended if it is (6) and |deltaVL|<=deltaVL0. -- (7) and the value then set as the variable delay means are memorized as a time delay preset value at the time of the completion of adjustment. In other than the above, the time delay preset value set as the variable delay means so that deltaVL may become small according to the positive/negative of deltaVL is set to S2. Next, it returns first, and an offset ingredient is detected in the state of S2, this is asked for difference deltaVL[of VL1' and VL2']' as VL1' and VL2', and the same tuning as the case of the above-mentioned deltaVL is repeated. By carrying out by repeating this processing loop, gradually, it can converge and the time delay preset value can acquire the time delay preset value at the time of the completion of adjustment eventually.

[0052]in addition -- a book -- an embodiment -- an example -- **** -- a delaying amount -- a preset value -- an increase -- VL -- one -- reduction -- VL -- two -- an increase -- becoming -- a sake -- VL -- one - VL -- two -- positive/negative -- distinguishing -- (-- eight --) -- VL -- one - VL -- two -- > -- zero -- a case -- **** -- a delaying amount -- a preset value -- increasing -- (-- nine --) -- VL -- one - VL -- two -- < -- zero -- a case -- **** -- a delaying amount -- a preset value --

decreasing -- making -- (-- ten --) . However, not the thing restricted to this but the important point just adjusts a delaying amount preset value so that the difference of VL1 and VL2 may become small.

[0053]When it becomes clear that there is an information storage side which should be reproduced from one side by a disk discrimination method more than two-layer, The result is recorded, the time delay of offset is adjusted with the method which applied to which and mentioned the focus servo above to the 1st information storage side first, the time delay of offset is adjusted in a similar way, applying a focus to the information storage side of the 2nd henceforth next, and the result is recorded. Using the recorded result, it can adjust so that an offset amount may serve as the minimum mostly for each information storage side of every. And in changing an information storage side, while having interrupted tracking servo control in advance of the change of an information storage side, it becomes possible to carry out tracking control with the tracking error signal by which offset control was carried out by changing a time delay preset value at the time of tracking control.

[0054]

[Effect of the Invention]According to this invention, the inhibition method of the tracking error offset which is suitable for practical use about an optical disk unit with required signal regeneration speed using those with two or more and each signal regeneration speed, changing them working is realizable. The optical disc which an optical disk unit makes a reproduction object can control tracking error offset about the optical disk unit with which those with two or more kinds may differ from the pit depth on which information is recorded among them. Tracking error offset can be controlled about an optical disk unit with required the information storage side which should be played from one side using it for the optical disc which an optical disk unit makes a reproduction object between ****s and those layers more than two-layer, changing to it working.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The block diagram of the optical disk unit which accomplishes the constituent features of this invention in the 1st example of an embodiment of this invention.
[Drawing 2]The phase contrast tracking offset regulated treatment flow chart of this invention.
[Drawing 3]The processing flow chart of the offset control portion among phase contrast tracking offset adjustments of this invention.
[Drawing 4]The key map which made the time delay preset value the parameter for the relation between the amount of tracking actuator displacement, and an offset value.
[Description of Notations]
1 Photodetector
2 Current-voltage conversion circuit
3 Variable delay means
4 Signal adding means
5 Binary-ized means
6 Phase contrast-voltage converting means
7 Delaying amount adjustment device
8 Optical disc
9 Optical pickup
10 Delay control signal
11 Tracking error detection means
12 Offset detection means
13 Tracking error signal
14 Tracking actuator shift signal generating means
15 Tracking actuator driver
16 Disk motor control signal generation means

17 Disk motor driver
18 Disk motor
19 Controller
20 Rotation speed signal
21 Mirror area
22 Information storage field
23 Disk discrimination method

[Translation done.]

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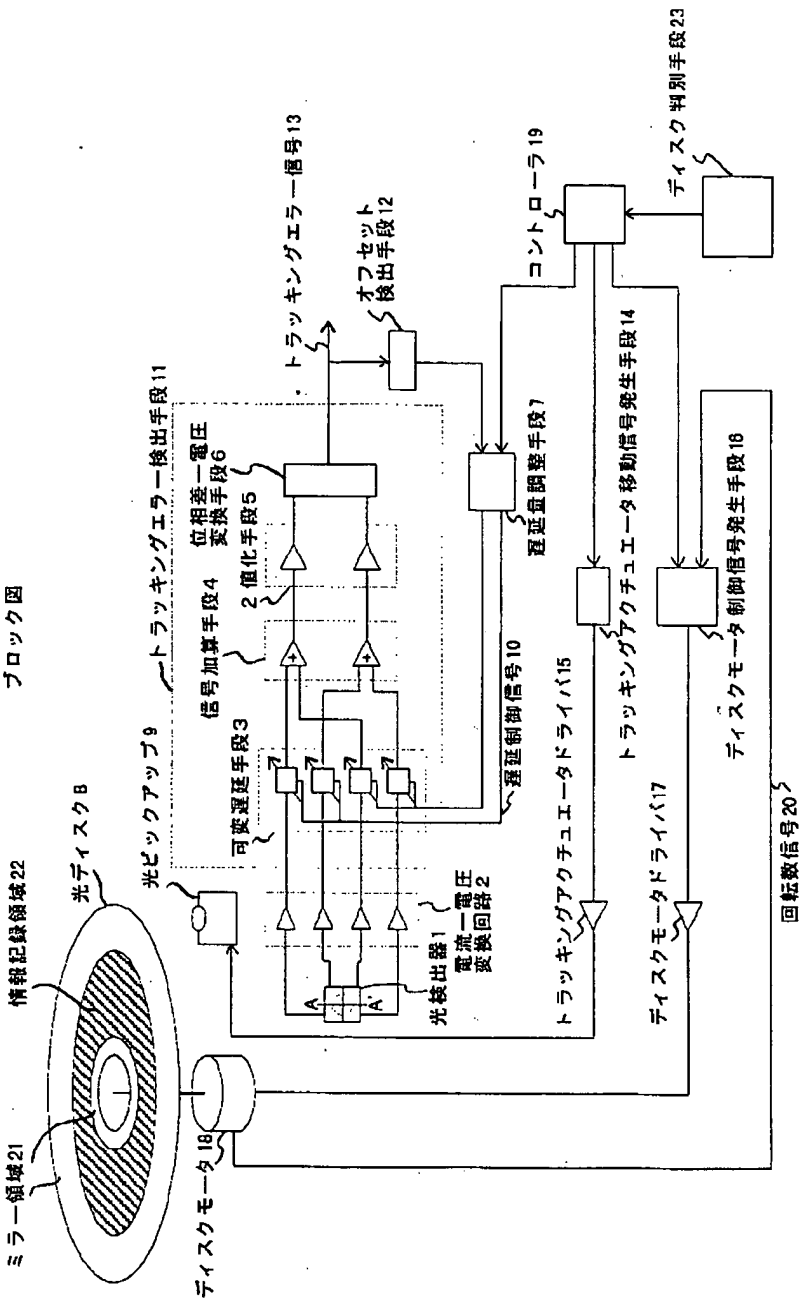
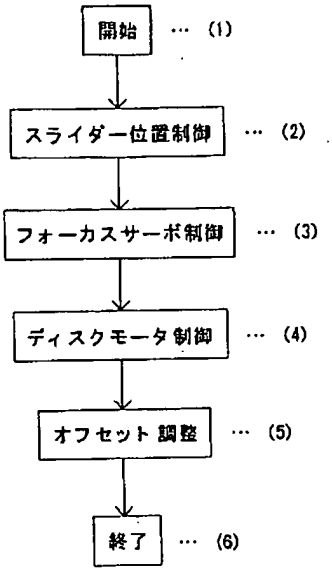
DRAWINGS

[Drawing 1]


ブロック図
情報記録領域22
光ディスク8
ミラー領域21
ディスクモータ18
光ピックアップ9
トラッキングエラー検出手段11
光検出器1
電流－電圧変換回路2
可変遅延手段3
信号加算手段4
2値化手段5
位相差－電圧変換手段6
トラッキングエラー信号13
オフセット検出手段12
遅延量調整手段7
遅延制御信号10
コントローラ19
ディスク判別手段23
トラッキングアクチュエータドライバ15
トラッキングアクチュエータ移動信号発生手段14
ディスクモータドライバ17
ディスクモータ制御信号発生手段16
回転数信号20

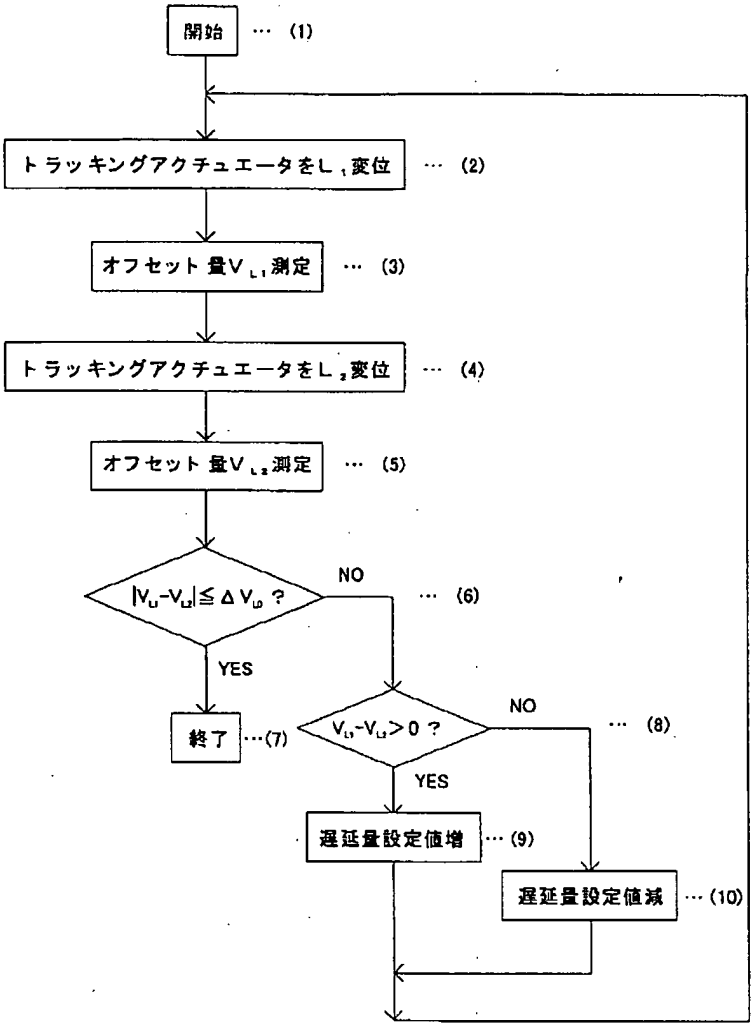
[Drawing 2]

位相差トラッキングオフセット調整フローチャート



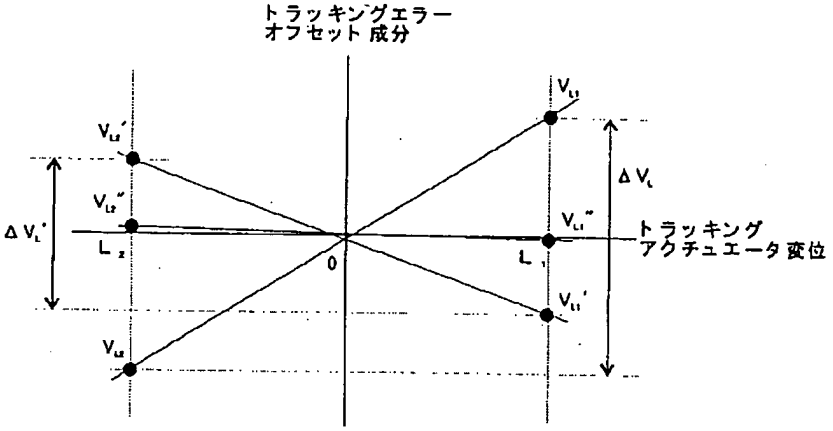
[Drawing 3]

オフセット 調整フローチャート



[Drawing 4]

トラッキングエラーアクチュエータの変位と
オフセット成分の関係



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CORRECTION OR AMENDMENT

[Kind of official gazette]Printing of amendment by the regulation of 2 of Article 17 of Patent Law

[Section classification] The 4th classification of the part VI gate
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G11B 7/085

7/09

19/12 501
[FI]

G11B 7/085 E

7/09 A

19/12 501 N

[Written amendment]
[Filing date]January 29 (2001.1.29), Heisei 13
[Amendment 1]
[Document to be Amended]Specification
[Item(s) to be Amended]The name of an invention

[Method of Amendment]Change
[Proposed Amendment]
[Title of the Invention]An optical disk unit and a tracking error offset adjustment method
[Amendment 2]
[Document to be Amended]Specification
[Item(s) to be Amended]Claim
[Method of Amendment]Change
[Proposed Amendment]
[Claim(s)]
[Claim 1]In an optical disk unit which uses a phase contrast tracking error detection system for a tracking error detection system,
A photodetector quadrisected by the 1st parting line established in the direction by which an information storage track is mapped, and the 2nd parting line established in the vertical direction to said 1st parting line,
A variable delay means constituted so that the delaying amount same when said 2nd parting line divides to 4 sets of signals from this photodetector as a signal from a light-receiving portion in a position arranged to the same field might be given,
2 sets of adding means constituted so that a signal from a light-receiving portion which is in a diagonal position on said photodetector among 4 sets of signals outputted from this variable delay means might be added, respectively,
A tracking error detection means to acquire a tracking error signal from phase contrast between signals outputted from this adding means,
An offset detection means to detect an offset ingredient of a tracking error signal outputted from this tracking error detection means, and a delaying amount adjustment device which outputs a delay control signal to said variable delay means so that an offset ingredient outputted from this offset detection means may serve as the minimum mostly,
A tracking actuator control means only for a predetermined distance to displace a tracking actuator,
A disk motor control means for rotating a disk motor at predetermined number of rotations,
A slider control means to which a position is made to move a slider in which an optical pickup was carried,
A focus servo control means for applying a focus to a signal recording layer of the purpose of an optical disc with which it was equipped,
A controller which controls said optical disk unit is provided,
When it is in a specific state judged that this controller needs reduction of said offset ingredient, It is made to control so that disk motor number of rotations turns into target revolving speed to said disk motor control means, Light spot irradiated by said tracking

actuator control means on said optical disc makes it control so that only a predetermined distance of said optical disc radially is displaced, Said offset detection means is made to detect an offset ingredient of a tracking error signal in said specific state, An optical disk unit performing offset control processing performed by changing a delay control signal which said delaying amount adjustment device gives to said variable delay means based on information about a detected offset amount repeatedly until said offset amount becomes below in a predetermined value.

[Claim 2]In the optical disk unit according to claim 1,

It has a disk discrimination method which distinguishes classification of said optical disc, When this optical disk unit is equipped with an optical disc, this optical disc makes it, as for said controller, distinguish to this disk discrimination method whether it is the optical disc in which said optical disk unit corresponds, When said optical disc distinguishes that it is the layered disk in which said optical disk unit corresponds, while making said delaying amount adjustment device perform delaying amount adjustment of preferably as opposed to [at least one] all of a layer of said optical disc, An optical disk unit outputting a memorized delaying amount adjustment result corresponding to a signal recording layer to play as a delay amount control signal from said delaying amount adjustment device in making this delaying amount adjustment result memorize and playing a signal from said optical disc.

[Claim 3]In the optical disk unit according to claim 1,

Operation for which a slider in which an optical pickup was carried at a slider control means is moved to a position before said controller makes a delaying amount adjustment device perform delaying amount adjustment to said optical disc, An optical disk unit performing operation which makes a signal recording layer of the purpose of said optical disc apply a focus to a focus servo control means.

[Claim 4]In the optical disk unit according to claim 3,

An optical disk unit, wherein fields where light spot under delaying amount control plays a signal from said optical disc are fields other than a mirror surface of said optical disc.

[Claim 5]In the optical disk unit according to claim 1,

An optical disk unit, wherein target revolving speed of said optical disc controlled by a disk motor control means at the time of offset control is number of rotations corresponding to the usual signal regeneration speed in a position to which said slider control means moved a slider in which an optical pickup was carried.

[Claim 6]In the optical disk unit according to claim 5,

When this optical disk unit supports two or more signal regeneration speed, Target revolving speed of said optical disc controlled by a disk motor control means at the time of offset control, An optical disk unit, wherein said slider control means is the number of rotations corresponding to signal regeneration speed between the minimum signal regeneration speed in a position to

which a slider in which an optical pickup was carried was moved, and the highest signal regeneration speed.

[Claim 7]In the optical disk unit according to claim 6,

With signal regeneration speed near signal regeneration speed of an average of the minimum signal regeneration speed and the highest signal regeneration speed corresponding to target revolving speed of said optical disc controlled by a disk motor control means at the time of offset control. An optical disk unit being the number of rotations corresponding to signal regeneration speed which can be set as said optical disk unit.

[Claim 8]In the optical disk unit according to claim 1,

Said tracking actuator control means quantity which displaces a tracking actuator at the time of offset control, An optical disk unit characterized by being a distance almost equal to an optical disc radial direction, and the direction of the displacement being reverse direction a center [a mechanical center valve position of a tracking actuator].

[Claim 9]It has the photodetector quadrisected by the 1st parting line established in the direction by which an information storage track is mapped, and the 2nd parting line established in the vertical direction to said 1st parting line, Are a tracking error offset adjustment method in an optical disk unit which uses a phase contrast tracking error detection system for tracking error detection, and this optical disk unit, Variable delay processing is performed so that the same delaying amount as a signal from each light-receiving portion divided by said 1st parting line in a position arranged to the same field may be given, when said 2nd parting line divides, Add a signal from a light-receiving portion which is in a diagonal position on said photodetector among these 4 sets of signals that carried out variable delay processing, respectively, and 2 sets of signals are generated, A tracking error signal is acquired from phase contrast between 2 sets of generated this signals, Have the composition which detects an offset ingredient of this tracking error signal, and said tracking error offset adjustment method, Control an optical disc with which it was equipped to become target revolving speed, and light spot irradiated on said optical disc controls so that only a predetermined distance of an optical disc radially is displaced, and it detects an offset ingredient of said tracking error signal, A tracking error offset adjustment method performing processing to which a delaying amount of said variable delay processing is changed based on information about a detected offset amount repeatedly until said offset amount becomes below in a predetermined value.

[The amendment 3]

[Document to be Amended]Specification

[Item(s) to be Amended]0018

[Method of Amendment]Change

[Proposed Amendment]

[0018]With the control signal of the controller 19, the disk motor control signal generation

means 16 gives a driving signal to the disk motor driver 17 in order to rotate the disk motor 18 at predetermined number of rotations by predetermined timing. The number of rotations of the disk motor 18 is detected by a rotational frequency detection means (not shown), and the rotation speed signal 20 is inputted into the disk motor control signal generation means 16. The disk motor control signal generation means 16 controls a driving signal to become predetermined number of rotations based on the rotation speed signal 20. The disk discrimination method 23 detects the existence of wearing of an optical disc, the classification of the optical disc with which it was equipped, etc. from an RF signal, a focus error signal, a tracking error signal, etc., and outputs a detection result to the controller 19.

[Translation done.]